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Willett & Gray's Statistical says: "Taken altogether, the situation in the raw sugar market may be considered steady and firm, without any special indications at the moment on one side or the other. Our Cuba crop information is especially valuable, as indicating that good progress has been made with the growing crop, notwithstanding the prevalence of heavy rains throughout the island, some parties even advising that conditions of flood have been detrimental to the cane, to some extent, while others maintain that any such damage has been fully offset by favorable conditions as a whole, so that we are inclined to believe that the average prevailing conditions must be considered favorable, and that a large increase in the Cuba crop is beyond question. Whether it will exceed 800,000 tons or not, it is too early to predict. The present crop of the island has now reached a visible production of 605,000 tons, with receipts for the week at 2,000 tons, and two centrals grinding, with stock in the island of 142,000 tons, against 61,383 tons last year."

Good demand for refined fair, with withdrawals heavy. List prices are revised, with American Sugar Refining Company quoting granulated at 5.50c., with Arbuckle's selling at 5.45c.

New York, July 19.—During the greater part of the week the stagnation in our raw sugar market was more pronounced than it had been in any previous week in the present year, the sales up to yesterday being limited to 125 tons Centrifugals at last price. Yesterday, however, the stagnation was broken by sellers giving way 1-32c. on Centrifugals and 1-16c. on Muscovados and Molasses sugars, all in port, and aggregating about 2500 tons.

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Coffee.—Coffee values have undergone a further inevitable decline purely as a result of the weight of merchandise. From what we can gather Coffee is about in the same demoralized condition as now exists with Refined Sugar. It may be supposed the country could buy freely, but interior dealers do not come into the market to any extent.

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## *THE FRUIT DRYING INDUSTRY OF CALIFORNIA.*

Only those who have visited the orchards of California in harvesting time can have a correct idea of the vastness of the fruit drying business of that state. Each year shows an increase of the quantity of fruit harvested, and the improvement in the methods of handling. While the prune crop this season has been practically destroyed by late frosts, the apricots and peaches are nearly an average yield, and we had the pleasure of witnessing the gathering and curing of the apricot crop, which covers fifteen to thirty days. The gathering is done by hand, as also the cutting of the fruit into halves, and spreading them on trays to dry in the sun. As fast as the trays are filled, empty ones are placed over them and filled till the piles are too high to handle. The trays are then removed to the drying house. The fruit is then cured by sulphuring which is done in well enclosed air tight houses. When this process is over, the trays are run out into an open yard to dry in the sun. As it seldom rains there during the drying season, this work continues without interruption through the season, the fruit when dry being sacked and sent to the packing houses. Not unfrequently from 100 to 200 tons of fruit are undergoing the process on one orchard. Peaches and prunes are handled in a similar way, with such variations as experience has shown to be best, great care being taken to keep all these fruits free from dust and dirt.

There is a process called "glazing," which consists in dipping the dried fruit in a mild syrup, giving it a more agreeable taste. Any one may notice this saccharine taste, when eating these dried fruits. This process makes them more palatable and saleable. Different growers are partial to their favorite varieties of fruit, but really there is very little difference in them when cured and put in jars for sale. The demand for these fine fruits is increasing very rapidly, especially by Europeans.

The curing of prunes is very similar, but the crop of this fruit for the current year was partially destroyed by the heavy frost which killed the young fruit, over nearly the whole prune area of the state, a few valleys however were exempted from the frost. The orchards are kept in very fine condition, like a garden, and these orchards extend from forty to fifty miles along the level plateaus at the base of the mountain range. A favorable year will return an enormous crop of prunes as well as of other preserved fruits.

At Buffalo one section of the Agricultural building had the finest exhibit of California and Oregon fruits, including apples, pears, apples as well as melons, berries that have ever been displayed anywhere in the United States. They were really marvels, and attracted the attention of crowds, who could hardly believe that they were bona fide fruits.

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In this issue of the Monthly will be found an article on fertilizing of cane soils in these islands, by Prof. Crawley, which no sugar planter should fail to carefully read and put into practice, where the conditions are such as call for this treatment.

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The latest estimate (July 3) of the sugar crops of the world, as made by Willett & Gray, make the total 9,531,881 tons—an increase over the previous year of 1,056,896 tons. It is a great thing for the consumers to have low cost sugar, coffee, flour, and fruits. It is in reality a consumers' millenium. The consumption of sugar will no doubt increase in about the same rate as its production, so that there will be no overstock.

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The German Government fixes annually the maximum quantity of production in the sugar factories, any excess beyond which is subjected to a tax equal to the premium on export. The total figure for 1900-1901 was 1,989,323 metric tons; the real production is given by Licht as 1,970,000 tons. The Kontingent for 1901-1902 is 2,079,000, that for 1902-1903 2,129,047 metric tons. The quantities are in raw sugar equivalents.

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Worry means death; cheerfulness means life. Hearty, genuine, irresistible laughter is most refreshing to the tired mind, and of more value in restoring the healthy poise than any drug or medicine. It reacts on the heart and the liver, the lungs and the stomach, sending the blood vigorously throughout the system. It imparts a healthy tone to the entire body.

The delicate adjustment of the system, so easily disturbed by a sleepless night of anxiety, is often restored by a hearty laugh. But with the digestive functions in good condition, a cheerful temper, and seven or nine hours' sleep, and with a careful exertion of his powers, it has been demonstrated that there is almost no limit to what man may accomplish.—Prof. Maby.

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Prof. Koebele, during his recent visit of inspection on Kauai, found the cane borer less destructive than it was last year. After trying several methods of destroying these pests, he thinks the best and surest way is to have women and children go through the cane fields, to search for and kill them. A little practice in this method soon enables them to dislodge and destroy the pests. Fields that have been treated thoroughly in this way, show very little injured cane, as compared to those not so treated. The best time for doing this is when the cane fields are being stripped, as this work of stripping off the leaves starts them out from their hiding places in the stalks. The beetle which attacks the cane fields of Louisiana is a different insect from that in our fields, though they work in the same way—boring into, and thus killed the cane stalk. Whatever the labor of searching for and killing the borers may cost, it is money well spent, resulting in an increase of sound stalks and consequently of juice and sugar. The borer is one of the pests which sugar planters will have to contend with, and those who are the most watchful and persistent in their efforts to combat this enemy of the cane-grower wili find their yields of sugar up to expectations.

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Russian sugar is finding ready sale in Egypt in consequence of the Daira Sanieh having ceased to make sugar for local consumption. This would have been an opportunity for Austrian sugar to recover some of its lost ground, as Russian "crystal sand-sugar" is cheaper than other European products. It is also commencing to compete very successfully in the South of Persia, and with Austrian and German in Japan. For some little time the entire sugar trade of Northern Persia has been in Russian hands. It seems singular that Russia should be able to so successfully compete with other sugar-producing countries. As a consequence, the price of refined sugars the world over is sure to be affected.

## *BEST VARIETIES OF SUGAR CANE.*

As our readers may be aware, experiments are being carried on in Louisiana, Jamaica, Demerara and other places to ascertain which are the best and most profitable varieties of cane for cultivation. It will take some years to decide this question no doubt, but experiments to date show that several—some of them new seedlings—are superior in several respects. The following is from one of Dr. Stubbs' recent reports:

The station has imported nearly every available foreign variety of cane and has had them under cultivation for years. Some of them have merit, but not deemed worthy of replacing our home canes. They are still grown, to study the influence of continuous cultivation upon them in this climate as regards their hardiness, sugar content, power of rattooning, etc. Hope has, however, been abandoned of ever securing from them a cane superior to our ribbon or purple varieties.

But high expectations are placed upon some of the "seedlings" which are now being disseminated throughout the sugar world.

Many years ago the Station received from Prof. Harrison, of Demerara, a number of seedlings. These have ever since been carefully experimented with, both in the field, in the laboratory and in the sugar house. Of these, two, D74 and D95 have shown qualities admirably adapted to this soil, in tonnage, sugar content, hardiness and vigor of growth. Two years ago a distribution of these canes among the planters of this and adjoining States began. Last year over 1,250 bundles weighing in the aggregate over 30 tons, were shipped throughout Louisiana, Texas, Mississippi, Alabama and Georgia. The supply was totally inadequate for the demand, and over 500 applications were referred to the crop of the present year. These canes have been distributed with the request of thoroughly testing them before cultivating on a large scale. Should they prove (especially D74) as satisfactory elsewhere as here, they will be a valuable addition to the sugar interests of the South.

There are also on trial a number of seedlings received several years ago from Barbados, and 12 new seedlings obtained during the past summer from Prof. Hart, of Trinidad. This large number may give a variety superior even to D74 and D95.

## *THE BRITISH SUGAR DUTY.*

As our readers are doubtless aware, a duty has recently been imposed on sugar imported into the British Kingdom. On its introduction into Parliament, Sir M. Hicks Beach, on behalf of the ministry, made the following remarks: It was desired to levy a tax on some article of universal consumption, which was very cheap. It had therefore been decided to tax sugar. This staple was being imported into the country at the present time to the amount of 31½ million cwts. per year. It was an article which was taxed in every country in Europe. Yet he considered it doubtful what the effect of a tax would be on the price of sugar, because the latter was largely governed by the Continental bounty system. Sir Nevile Lubbock, in a letter to The Times, says this admission is satisfactory, but it could only be gathered from the opening remarks of the Chancellor of the Exchequer that he hoped these bounties would be increased, and so reduce the price of sugar to the extent of the duty proposed to be introduced. He proposed to levy a duty on refined sugar of 4s. 2d. per cwt. A halfpenny per lb. on sugar would be 4s. 8d. per cwt.; this left a margin of 6d. for the dealers to meet the charges that they might have to bear, consequently the retail price should not increase more than ½d per lb. As to the effect of this burden on the working classes, it might be borne in mind that in 1893 the price of sugar was 18s. per cwt., last year it was under 13s. per cwt., hence prices would not be higher than in 1893, when no complaints were made. With regard to raw sugar, it would be taxed according to purity, and the polariscope would be the method of testing employed. The duty on sugars polarizing 98° and above would be 4s. 2d. per cwt., and the duty on those polarizing below 98° would diminish according to the polarization till it fell to the minimum of 2s. per cwt. on raw sugar polarizing no more than 76°. The polarization figure marked on the bill of lading would be generally accepted by the Customs House, but the latter would from time to time make tests with their own instruments. It was not intended to exempt West Indian sugar, nor would they do anything to protect the British refiner to the disadvantage of the consumer. Cane and beet sugars were to be treated alike. Among the reasons advanced in support of the measure were the following:

1. The Chancellor of the Exchequer needs money.

2. We Englishmen are patriotic enough to do anything for the welfare of our country, and will gladly make this small sacrifice.

3. Sugar is sold by the pound and is therefore a right object for taxation.

4. Practically every person living in the United Kingdom would contribute.

5. The beer drinker, the teetotaller, the drinker of aerated waters, the consumer of sweets, jams, etc., would all alike have to contribute.

6. We should help our colonies who have helped us.

7. We should help the decaying English sugar refining industry.

8. We might grow our own sugar, save our country twenty millions sterling per annum, and help the distressed British agriculturalist.

9. A sugar tax would bring to the Chancellor of the Exchequer eight millions sterling per annum. It would be easily collected, would cost the consumer only $\frac{1}{2}$d. per lb., and it would be the most just among all taxes we have to pay.

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## *THE SUGAR SITUATION.*

Hon. R. B. Hawley, of Texas, who has extensive sugar interests in Louisiana and Cuba while in New Orleans gave his views on the sugar industry. From the N. O. Picayune the following is taken:

For the past several days Congressman Hawley has been investigating the furnaces in Louisiana and Texas in which oil is used as a fuel and looking into its utility in the industrial field of the South. There can be no doubt that this investigation will bear significant fruit, and that he is looking to a prospective introduction of the oil as fuel on the sugar plantations in Texas, Louisiana and in Cuba.

"I regard this oil as the greatest of factors, the greatest boom to all our Southern industrial interests," said Mr. Hawley, "but particularly to the maintenance and development of the sugar and rice industries in both Texas and Louisiana. In the production of sugar it means an economy of $\frac{1}{8}$ to $\frac{3}{8}$ of a cent per pound for every barrel of sugar made in the State.

On some plantations the saving may reach as high as a quarter of a cent per pound."

When asked if he thought oil would be used in the Cuban plantation furnaces, he replied, "I do. I think they will use oil in Cuba and in every other country adjacent to ours where fuel is imported. It may be thought that this speculative fever which is abroad, and which has in a measure subsided, represents this development, but it has nothing to do with the substantial and permanent relation of this find; not only for our use in the development of untold industries, but as an export article in the return of millions to enrich our people. And as the sugar industry is now facing some new conditions, oil is especially welcome. I know there is a good deal of speculation in this State as to what these conditions will be, and it is difficult to determine, but the Platt resolution is the law of this country. In the judgment of the best-informed men, there will be no recession from it, and when accepted by the people of Cuba, as it is believed that it will be, there will immediately follow an earnest to bring about a treaty between America and Cuba that will admit American products there on most favorable terms and Cuban products here. And reciprocal trade relations are reasonably certain to be established. This can be done, however, without permanent injury to the sugar industry of this country. On the other hand, if such reciprocity is not established, to speak directly to the point, it will result in a speedy annexation of the island. It may be argued that there is a disadvantage to the growing industry of the country to open the door of reciprocity to all. But as against that argument, it is the deliberate judgment of men who will have a potent voice in determining this matter to accept a reduction in the commodities of both countries in the interchange of commodities with each other, and with it a reduction of the duty on sugar to such an extent only that our interests can bear it, or rejecting it, might invite a condition that will prove so onerous that the situation would become difficult and unsatisfactory.

"Without wishing to intrude my own judgment, I believe the treatment of this whole question will be so conservative and wise that reciprocity can exist in such a degree that the sugar industry in Louisiana can survive and prosper."

## *LOUISIANA AT THE PAN-AMERICAN.*

Dr. Wm. C. Stubbs, who has returned from the Pan-American Exposition at Buffalo, is quoted as having said the following regarding our State exhibit there: "We have an exhibit in Buffalo, of which I think every Louisianian can feel proud when he goes there and sees it in comparison with the other State exhibits. We haven't near the space which we would like. Everybody has been crowded and kept down to limited quarters. We have 1,500 feet in the agricultural building, and 500 feet in the forestry building—that is not near all we could use with effect and comfort, but we have to be satisfied.

"In approaching our exhibit, you will see on the right our five bales of moss. Back of that is the forage, the wheat and the oats and the stuff in the sheaf. On two long tables you will find 250 glass jars that contain samples. In the front are our fruits and some 200 glass jars with fruit in them. Our large sweet potato is the attraction of the show. It weighs 122 pounds and is labeled. Everybody comes to see it. All around the giant member are the other sweet potatoes as they are grown in this state.

"Across the way are the minerals of the State; the oils, turpentine, sulphur, rosin, the byproducts of the pine knot, soda and salt, besides many other kinds of mineral products.

"Then in front begins the cotton display, which gives an idea of the industry all the way from the plant in the field, from the seed before it is planted to the cotton in sixty-five big bales and to the finished product of the mills. We are showing ten varieties of the cotton seed oils. The manufacture of the goods is not left out, and what the State is doing in that direction is represented. A fine cotton plant, life size, in wax, is on exhibition. Then are shown the different processes of baling—the round, the square and the oblong processes. They are all there, side by side.

"The fiber crops are given good space, jutes, hemp, ramie, palmetto and other varieties are there. Next comes the oyster industry of Louisiana. A map is the first pointer. It places before the eye a birdseye view of the 7,267 square miles of oyster grounds in the State, and then are to be found samples from Morgan City, Terrebonne, Barataria, Dunbar and others. The byproducts and the sauces of Iberia and other points are in the display. Waxed fruits and vegetables are given a show.

"The sugar industry finds a section to itself, and there the visitors are instructed, if they care to be, in the industry of the lower Mississippi valley. We have twenty-one varieties of plantation sugar and eight varieties of cane molasses. Refined sugars as turned out by the highest art of refining and done here in New Orleans follow in their place. The distilled products from molasses and sugar are a part of the exhibit. A complete sugar-house in diminutive form is at the side of the sugar display, and it is attracting great attention. It shows every process and the vats and pans are in their proper places. Corn and like products are not left out. In fact, I think we have fine exhibits of everything produced in the State in the way of agriculture. On the right are some appropriate mottoes. Some of the sentiments, not trying to remember the wording exact, are:

"'Louisiana, the most fertile State in the Union; $96,000,000 in products from 3,000,000 acres of land, which is divided up something as follows: $35,000,000 from the sugar industry; $35,000,000 from the cotton industry; $8,000,000 from the rice industry; $12,500,000 from the corn and $5,500,000 from the remaining agricultural products.'

"What does it mean to us," repeated Dr. Stubbs in conclusion. "It means that we are alive and progressive. Possibly it is not necessary to call the attention of the country to our State and its resources. The country is pretty well informed of those things already, but it will do good anyway. The eyes of the whole country are now centered on the South, and the exhibit at Buffalo will help to focus that concentration on Louisiana and on New Orleans."

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We have received from parties in Porto Rico a circular requesting the publication of articles complimentary of a new process for refining sugar direct from the vacuum pan, without the aid of a refinery. Such a process may be possible, and very likely will be discovered, thus simplifying the methods now required of having special refineries for this purpose. That such a change in the present methods is desirable no one can doubt; but whether the claim of the parties in Porto Rico can be established, we have as yet no satisfactory proof.

## *THE AMERICAN REFINERY'S PLANS.*

A dispatch from Porto Rico reports that the "sugar trust" —presumably the American Sugar Refining Company—is engaged in getting options on large sugar land estates near that city and in other parts of the island. If the report is true it may fairly be assumed that President Havemeyer is not prepared just yet to abandon the use of cane altogether in the manufacture of refined sugar, and thus to help along the alleged inevitable supremacy of the sugar beet in America. He is on record with certain opinions bearing directly on this subject. Before the United States Industrial Commission, not so very long ago, in reply to a question as to whether or not, in his opinion, the beet industry will eventually supply all the sugar consumed in the United States, he replied as follows:

"If the people of the United States continue to consent to a burden of $40 a ton on imported sugar, I suppose that one of these days the beet sugar industry will furnish the United States with all it consumes, provided Porto Rico and the Philippines are not annexed, or their products are imported free."

In other words, if the Dingley tariff tax on foreign sugars is continued and products from the Philippines, Porto Rico and Cuba are to be regarded as "foreign," importations of sugars will gradually decline, until finally they cease altogether, and the sugar supply of this country will come chiefly from beets, even the cane of Louisiana and Hawaii gradually disappearing.

But, explained Mr. Havemeyer, Cuba, Porto Rico and the Philippines could easily supply the United States with every pound of sugar that it requires, even without any dependence on Louisiana and Hawaii; and he plainly intimated that, with the duty from their products removed, the threatened or predicted ascendency of beet sugar in this country would not materialize.

"If that is done," asked Mr. Kennedy, of the commission, "the beet sugar industry will have to be suppressed, will it?" "Well," was Havemeyer's reply, "it would be relegated to where it properly belongs—in competition with cane."

Mr. Havemeyer has beet sugar interests on the Pacific slope, but none east of the Rocky Mountains. Would he be likely to acquire cane lands in Porto Rico unless he felt reasonably sure that the products of that island are hereafter to come into the United States free of duty! If the American Sugar Refining Company is actually preparing to develop Porto Rico sugar lands, perhaps the country may as well begin to prepare itself for a Supreme Court decision proclaiming Porto Rico to be a territory of the United States, with no more restrictions on her trade with the mainland than New York or Oklahoma has.—N. Y. Com'l.

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## *THE QUEENSLAND SUGAR PLANTERS AND THEIR LABORERS.*

The sugar planters of Queensland appear to have been thrown into a ferment, not altogether unexpected, by the proposed action of the Commonwealth Parliament to prohibit the importation of South Sea Islanders to work in their cane fields, as has been the practice for many years. The following extract from the Sugar Journal will afford some idea of the situation in that colony:

At least one distinct advantage has been gained by the sugar producers of this State from the debates which have recently taken place in the Commonwealth Parliament. They have been enabled to learn what are the remedies by which the anti-Polynesian politicians propose to supply the want of Kanaka labor. We may as well first look at some of the methods by which we are to carry on sugar production. If any of them appears absurd, this it not our fault, but rather the misfortune of the men who made them, and who unfortunately are talking upon a subject of which they are totally ignorant. First and foremost we are assured by some that if we cut up the large estates and improve our work we can easily hold our own. Now at the present time there are in Queensland at least 1,500 cane farmers, and seeing that the total area under cane is 110,000 acres, this gives an average area per farmer of 73 acres. Surely not an excessively large amount. Being many years behind the times the legislators of the South are not acquainted with the history of the sugar industry during the past ten years, and do not know that we have been cutting up the large estates all the time, until, with the exception of two or three, there are now no really large sugar estates in the whole of Queensland. While it may also be argued that we could still further reduce the area of our farms, it must be recognized that the improved methods of cultivation, by which we presume fertilizing and irrigating are meant, are more expensive when carried out on a small scale, than on a large one, while it is open to question whether the very small farmers would under ordinary circumstances command the capital necessary to enable them to maintain the high state of cultivation, which is so earnestly advocated. Then again it is pointed out that the area under cane has increased by fifty thousand acres, while the number of Kanakas has not increased, and it is argued from this that consequently 50,000 acres of cane have been grown entirely without colored labor. In the first place a large number of farmers, working for themselves, and at times employing their own families in the fields, have reduced the number of Kanakas required to cultivate a given area of cane, while secondly field implements have also considerably reduced the hand labor bill, and that reduction will undoubtedly continue, but this affords no argument to show that we can at present do entirely without the Polynesians. As a matter of fact it is very open to question whether the scarcity of labor is not such that our farmers do less work to their fields than they should do, and it is certain that with a further decrease in the labor supply the quality of the cultivation must further depreciate. It would be well if this important phase of the subject were considered carefully. We are to improve our cultivation, and to employ white men at, say, 7s 6d a day, instead of Kanakas at half a crown. The ordinary work of hoeing, stripping, applying fertilizers, requires from the laborer no special training, but simple endurance and a willingness to work. The Kanaka does the work very well, but there are not sufficient Kanakas for the work to be done as often and completely as it should be. If we replace the Kanaka by a European at three times the wages, we shall get the same work done, but at three times the cost. Consequently if we desire to improve our cultivation we must put more labor into the fields, and more labor means a still greater outlay for the farmers. It is true that in the Sandwich Islands they can obtain four times as much cane from an acre of land as we get here, but the cost of that cane is very considerable, and the Sandwich Island planter would hesitate long before he would undertake to grow cane according to his methods, and in this country, and receive for it the price our central mills can only afford to pay. Of course we have heard of the increased price we are to get for our sugar in Australasia. We may or may not get a considerable increase, according to which political party has its own way, the freetraders in the Senate, or the protectionists in the House of Representatives."

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A Belgian consular report says that diffusion has been completely laid aside in Cuba. A French company some years ago set up several batteries in certain factories, but the results did not answer expectations, and the system was abandoned. It appears, however, that fresh trials will shortly be made with apparatus in which the diffusion will be effected under pressure. It is hoped that by this method of working as little as one-quarter of one per cent of the sugar will be left in the chips, while the ordinary bagasse, even after maceration and passing twice through the mill, contains three per cent. To make up for the necessary extra evaporation, quintuple effects will be used, and it is expected that a considerable saving will thus be effected.—Sugar Cane.

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It is a curious fact, says an exchange, that at this moment sugar is a leading factor in world politics. For the British government it is a revenue and tax question. For Germany, whose yearly production is 1,700,000 tons of beet sugar, nearly one-fourth of the total production of the world, it is tariff, bounty and export question. For Russia it is the same. And in the United States it is a tariff and colonial question. The cane sugar crop of Cuba, plus that of Louisiana and our island possessions would—if Cuba were annexed—make the American sugar crop equal nearly 1,000,000 tons a year, and the annexationists claim this would put us into formidable competition with Germany for the sugar trade of Britain and other non-sugar growing countries. But the tariff-propped interests of the Sugar Trust, on the other hand, it is said, require that Cuba shall be "free and independent," at least sufficiently so to enable the Trust to maintain the tariff barrier against her big sugar crop.

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Sugar stocks have declined here in sympathy with many stocks abroad, but whether this will be permanent or only temporary, remains to be seen.

## *TRINIDAD CANE EXPERIMENTS.*

### Report of the Royal Botanic Gardens for 1900.

By the courtesy of the superintendent, Mr. J. H. Hart, F. L. S., we have received the above report, from which we extract the following particulars relating to the sugar industry. "As regards the seedling cane experiments, it is well to remember that only those who are conversant with the special work are able to conceive or suggest reasons for variations and fluctuations which to an outsider appear almost inexplicable and often disheartening, even disastrous, and it is not surprising to find that it has been decided at the Gardens in question that "new seedling canes require to be tested some five years before being marked as varieties fit for extended cultivation."

The report says the cultivation given is not special, but similar to that practiced on a regular estate. For the planting season of 1900, 41,177 canes were distributed from the Gardens, and more than ten times the number would have been taken, if available. Mr. Hart observes that the success which has attended the cultivation of the Demerara seedlings D74 and D95 in Louisiana is remarkable, they being distinguished by quick ripening and high sucrose content; the time from sprouting to harvest in Louisiana being much shorter than in Trinidad. Most of the analysis made at the Gardens are of canes of 12 months' growth only, while Trinidad estates generally crush canes of 15 months' growth, and sometimes "stand overs" of as much as two years or more.

In most of the selections at the Gardens, both size and weight have been specially considered, but some smaller canes giving a high sucrose yield have been passed, being erect growing varieties which can be planted closely and would thus give a high tonnage. No. T111, T2 are of this class, and a plot of each is planted at half the usual distance for comparison with larger canes. One of these, T2, analyzed in 1898-99 and 1900, 18.1, 15.90 per cent, and 15.84 per cent sucrose respectively. T189, a seedling from the Demarara D95, "is a very promising purple cane of good size and robust constitution, with an excellent sucrose yield."

"The question of pollination of the cane by wind or insects is still unsettled, but the greatest variety and the best kinds came from seed harvested where several distinct kinds had been planted together, the inference from which is obvious."

As an example of the mode of cultivation and selection pursued, the course taken with T111 is given as follows: November, 1896—Seeds sown; May, 1897—Seedlings planted out in cane rows at regular field distances, no special cultivation being given; May, 1898—First field selection, first analysis, 2.33 lbs. sucrose per gal. juice (8 stools planted out to test as "plant canes," the canes this season were ripe and well grown, being 18 months old from seed;) May, 1899—Second field selection, second analysis, 2.16 lbs. sucrose per gal. juice (cane tested as "plant canes" were not well grown, owing to drouth and poor soil;) May, 1900—Third field selection, third analysis, 1.97 lbs. sucrose per gal. juice (cane tested as first ratoons and left for second ratoons, 1-20 acre at usual distance.) This year the canes suffered from drouth, and all canes generally analyzed 3 per cent lower than in the previous year. The following shows the number of canes selected per thousand:

Number originally planted, 1,000.

| | 1st season. | 2nd season. | 3rd season. |
|---|---|---|---|
| Reduced by field selection to . | 30 | 10 | 5 |
| Reduced by analysis to ..... | 15 | 9 | not reduced |

The report states, "It will therefore be seen that, by the method adopted, there is little chance of a poor cane coming to the front."

In the report for 1898, Mr. Hart stated, "The only true test of the success of a cane is to give it field culture on a large scale." He suggests that if the field trials could be carried out on one estate under Government control and the sugar manufactured on the spot, failures, such as have occurred through canes giving different results on different estates, would be obviated, or if trials could be made on private estates under supervision of the officials of the Department of Agriculture, as in Barbados, this would insure more satisfaction and greater correctness, and no variety would be sent into general cultivation until it was fairly certain that it could be grown with more profit than the commonly cultivated varieties.—The International Sugar Journal.

## *SPRECKLES' CALIFORNIA SUGAR FACTORY.*

The great Spreckles Sugar Factory, situated near Salinas City, is the largest establishment of its kind in the world. Its capacity is 3,000 tons of beets per day. The equipment of the mill is most complete, Mr. Spreckles having ransacked the world for the latest improvements and the very best material. The main building is of steel and brick construction, 582 feet long, 102 feet wide, five stories high, contains 5,500 tons of steel, 4,000,000 bricks, and 800 squares of slate. In this building are found all the latest patented contrivances for the manufacture of sugar from the beet root in the most economical and most approved methods. The building is divided, as it were, in three parts, the beet end of the house containing the beet screws, beet washers, four beet elevators, four beet scales, eight cutters, 56 diffusion cells, in four batteries of 14 cells each, four weighing tanks, five first saturation tanks, four second saturation tanks, filter presses and the various diffusion and filter heaters.

In the center of the building are the two sets of immense quadruple effects or evaporators, side by side with an additional set of double effect evaporators, while in the other end are found the various machines for turning out the finished product of sugar, viz., the vacuum pan tanks, the seven 14-foot vacuum pans, 28-48 inch centrifugal machines, 49 crystalizers, seven mixers, three sugar hoppers, nine sugar conveyors, nine sack conveyors from the scales to the railroad platform, all automatically handled.

The engine room occupies the central part of the immense building on the ground floor, and contains five vacuum pumps (fly wheels 20 feet in diameter), two gas pumps (fly wheels 20 feet in diameter), six sugar pumps, one beet engine (400 horse power,) two centrifugal engines (400 horse power), four electric generators, direct connected, two of 400 horse power and two 700 horse power.

Situated next to the main building in the east is the boiler house, 559 feet long, 68 feet wide and 32 feet high, containing 1,000,000 brick. Here are to be found 48 water tube boilers of 125 horse power each, four economizers, two lime kilns (14 feet diameter, 50 feet high), four gas washers, one lime elevator, three lime mixers, two lime settling tanks, one lime pump for milk or lime, four feed pumps for 160 pounds pressure per square inch, and connected with this immense boiler plant are the two steel stacks, each 216 feet high and 13 feet in diameter, each stack weighing, with its brick lining and base, 1,000 tons.

Next comes the machine shop, carpenter shop and store room, 559 feet long, 40 feet wide, 32 feet high. The three buildings are of fireproof construction throughout; no woodwork except the sheathing underneath the slate on the roof. All floors are made of concrete arches.

The fuel used is oil, of which 1,200 barrels are consumed every 24 hours.

The oil tanks are provided for storage, each 77 feet in diameter by 25 feet high, each having a capacity of 20,000 barrels or 850,000 gallons.

The entire factory is lighted by electricity. Water is provided partly from six wells 48 inches in diameter and 160 feet deep, each giving an abundance of beautiful clear water, and partly from the Salinas river, whence it is pumped through a mile of 32-inch steel riveted pipe by two centrifugal pumps, each pump having a capacity of 10,000,000 gallons per 24 hours, and each operated by a 200 horse power direct connected electric motor. In all about 13,000,000 gallons will be the daily consumption, though pumps are in duplicate and can handle twice that quantity. A reservoir has been constructed on the summit of the hill across the river from the factory. It is 200x60 feet at top and 200x20 feet at bottom, with a depth of 20 feet.

On the western side of the first floor of the main building are the multipolar generators which generate the electrical power for the entire factory system. There are four of these generators, two small and two large. The smaller are each of 1,200 amperes, with a speed of 150 revolutions, of 250 volts with no load, and 250 with a full load. They are of 402 horse power each. The larger are each of 2,000 amperes, a speed of 150 with 250 volts without a load, 275 with full load, and of 737 horse power each. The smaller is also 300 kilowats and the larger 550. To send the electrical current where it may be needed and to prevent its use elsewhere, has been erected a switchboard near the generator on the eastern side of the center of the first floor, which cost over $15,000. The board has 17 panels of the finest Tennessee marble and is 18 feet high and 32 feet in length. There are 24 switches, besides three of what are known as blade switches. Each generator has regulators for voltage as well as guages, known as volt meters and ammaters. There are four generators, eight 600-ampere-feeder and five 1,200-ampere-feeder panels, and there are also seventeen automatic circuit breaker panels to shut off the circuit almost instantaneously. Two of the panels have a capacity of 3,000 and 15 of 2,000 volts capacity. On the back of the board are double set Buss bars made of copper, which weighs five tons. The cables which connect the large generators with the switch, weigh three and one-half tons and and is called by electricians two and one-half million circular mills. The smaller generator cable weighs two tons, and is one and one-half million circular mills. Each panel is so constructed that lights burn on their frontage when in use.

At the extreme end of the boiler house, in a third section, but under its roof, has been erected an innovation in engineering skill and mechanical work, which is in operation in Salinas for the first time in the world. This new idea consists of two enormous steel lime kilns, which stand upon an open iron frame work base, some 4 feet high and then tower up through a circular opening in the roof to a height of 52 feet. These kilns are 15 feet 6 inches in diameter, lined with brick and concrete. Between the brick lining and the steel work ashes and cement have been packed solid.

Thirty feet above the kilns, or 86 feet in the air, the aerial electrical railway commences. This bridge, light, yet durable, thread-like in appearance, yet of great strength, is 640 feet long, after leaving the end of the boiler house and is supported by light spans of 140 feet each, built like a tramway, and its motive power will be electricity. There will be buckets especially adapted for carrying five tons of limestone rock from the immense flat outside, near the river bank, where it will be dumped when brought from the quarries. As each bucket reaches this rock it will be lowered automatically, filled, hoisted to the bridge and conveyed by an endless chain to above the kilns, where it is redumped and burned. From the kilns the burned rock is conveyed to the mixers, or slack pans.

At the end of the railroad bridge, which extends across the river from the factory, is the great yawning chasm, known as the silo pit. Into this huge gulf, from which 100,000 cubic yards of earth were taken, a portion of the pulp will be conveyed from the factory. On the crest of the hill overlooking the pit the huge 1,300,000 gallon reservoir, which has been covered, overlooking the factory buildings like an immense fortification. It is 200 feet long, 60 feet wide at the top and bevels to the bottom, where it is 20 feet wide with an average depth of 22 feet. Pipes ranging up to three feet in diameter have been laid from the reservoir across the bridge and to the factory, where they empty into the settling reservoirs. These are three in number, and are on the western front of the main building. They are immense circular wells, 100 feet in diameter, concreted top, side and bottom, and are six feet deep at the rim and 15 feet deep in the center. After the water has been pumped into them it is allowed to settle and the clear fluid pumped into the factory by pumps which are placed in the center of each well.

The factory will slice and crush 3,000 tons of beets per day of 24 hours and produce about 450 tons of sugar daily, raw or refined as may be required. The output of the season's campaign will be from 45,000 to 60,000 tons of sugar, according to the length of the run.

There will be distributed during the operating season $12,-000 per day for beets and $5,000 per day for labor and operating expenses. It will require 30,000 acres of land to supply the demands of the factory. Salinas valley affords 90,000 acres for beet cultivation.

The 30,000 acres under beet cultivation entail the expense for labor and seed of $22 per acre, in the aggregate $660,000. The same land sown in grain would entail an expense for seed, labor, harvesting and sacks of $5.25 per acre, or a total of $175,000—a difference with some significance. An element further to be considered in the problem of labor is that in hauling the grain crop one carries about three-quarters of a ton per acre, while with the beet crop one has 12 tons to the acre. Experience has also proven that after use of land for beet crops it is cleaner, and far better results are had in growing grain. The pulp from the factory will feed and fatten thousands of head of cattle.

The great factory has cost about $2,500,000. In addition to this land has been purchased and other improvements made, which will swell the amount expended by the Spreckles company on their great undertaking here to $3,000,000.—Salinas Index.

## *SUGAR ENGINEERING AND SUGAR CHEMISTRY.*

In ante-bellum days and even since then, the cultivation of the sugar cane and the manufacture of sugar therefrom proved a most profitable industry in Louisiana. In recent years, however, the beet sugar industry, carried on as it has been, by the best educated scientists, and the most skilled labor in Europe, has partly taken the place of the cane sugar industry which is now not so profitable as in former times. In those days when profits were so large, losses from improper management were hardly noticeable, but inquiry into the prevailing conditions has led to the conviction that, to succeed now in this business, more skillful labor and more intelligent control are needed, both in the cultivation of cane and the manufacture of sugar. Experience has taught that there must be an application of science to the preparation and fertilization of the soil, to the selection, planting and cultivation of the cane, and to the manufacture of sugar.

Not only the sugar planters, but the public generally are convinced that technically educated men are absolutely necessary for superintending the manufacture of sugar, so the Administrators of Tulane University of Louisiana, realizing the importance of the sugar industry to the section in which the University is located, and desiring to aid, as far as is practicable, in the improvement of the industry through the better training of those who have it in charge, have established, as one of the courses of the College of Technology, a course in sugar engineering. This course is one in which both the mechanical and chemical sides of the manufacture of sugar receive adequate attention, and yet one in which the general culture and training of the student is not neglected.

SUGAR ENGINEERING.—The name "sugar engineer" was coined at Tulane University. The meaning of the name can be given in a few words. Every sugar house is filled with machinery, either driven by steam, water or electricity; the processes carried on therein are both chemical and mechanical in their nature. The management of the process and the management of the machines in which the process is carried on should not be separated. The chemical and engineering control should be vested in a superintendent, who has been graduated in both chemistry and engineering as applied to sugar. Such a man is a sugar engineer and his work is sugar engineering.

Tulane University has initiated such a course. It is desirable to explain to the public, not only the object of this course, but also its means and its methods for the attainment of its ends. Its broad campus furnishes an area more than sufficient for raising sugar cane and if necessary, beets sufficiently good, for the practical work carried on in connection with the course.

Mechanical and Chemical Equipment.—The carpenter shop, pattern shop, machine shop, foundry, mechanical engineering laboratory, electrical, chemical and sugar laboratories, are second to none in the South in their equipment and the up-to-dateness of their methods. The shops are under the immediate control of a man of 20 years' experience in processes carried on in sugar and other factories. The engineering laboratories are directed by an engineer of many years' experience in handling marine engines and boilers in the United States Navy; the electrician has designed dynamos and motors for the market, and the professor of sugar chemistry has pursued chemical research work in Germany, and was for nearly two years connected with the Sugar Experiment Station of Louisiana, and is perhaps the only teacher in this country who devotes most of his time to the study and teaching of the chemistry of sugar. Evidently the faculty is composed of practical men, experienced in their separate departments and bent on teaching their specialty in a practical way.

In the course, as is now arranged, the student designs the bagasse burners, boilers, engines, mills, clarifiers, multiple effects, vacuum pans and sweet water pumps for a house grinding 500 tons per day. In a design for multiple effect, for instance, the student calculates the amount of water to be evaporated and thence the required heating surface and areas for steam pipes and feed pipes.

After this he makes the actual working drawings to scale. He then makes a study of the sugar house as a whole to obtain the best arrangement of the different machines for convenient and economical operations.

Lectures are given on the erection of sugar houses by a professor who has erected many complete sugar houses in this State. During the summer, students accompany and work under him to learn how to handle labor and how to erect machinery. Work of this character and magnitude cannot be done inside the walls of a university, but recognizing its importance the professors and students undertake it commercially.

Vacuum Pan Work.—Realizing the importance of sugar boiling, lectures are given on the laws of crystallization in sugar solutions, or how to form grain, build up grain, wash or melt out grain, the cause of the foaming, etc. These theoretical lectures are put into practice by taking the student to a plantation where the proprietor, who is an expert sugar boiler, personally instructs the student day by day during the season.

The chemical equipment is so complete that work of any grade, no matter how high, may be carried out. A mill and windrowed cane furnish juice whenever required. Samples of masse cuite, molasses, sugars and syrups, bagasse, ash of bagasse and molasses, coal, soil and fertilizers are collected, analyzed and studied by the students. Clarification and the best methods of chemical control of sugar house work as followed by the best chemists of this State and elsewhere are studied and discussed by students and professor. After this students are taken to a large sugar house where they take part in the actual work. Before taking up the work in sugar chemistry a student must have completed a collegiate course of general chemistry, qualitative analysis and some quantative work.

How Planters Lose by not Employing Competent Sugar Engineers.—A planter was asked if he had sustained any loss by not employing trained men and his answer was, "not less than $100,000 in the short time (about 15 years) that I have been in the business. I have learned," continued he, "that a capable engineer is much more economical than an incompetent one, although the latter demands much less for his services."

At a certain sugar house in Louisiana two years ago, the yield of sugar per ton of cane was not satisfactory. A competent chemist was called in and from the day that he took charge of the clarification and chemical control, there was an increase of 16 lbs. first sugar per ton of cane throughout the campaign. Assuming that this particular factory turns out 3,000,000 lbs. sugar per season and that 160 lbs. sugar per ton of cane was the average yield, and that the 16 lbs. gain per ton of cane under proper chemical control was one-tenth of a total yield, the loss to the proprietor would have been 300,000 lbs. of sugar. This amount at 4c. per lb. gives $12,000, enough to pay a competent chemist for four or five years.

Information is received from one factory that after washing out the pump with muriatic acid, the engineer in attempting to examine this piece of machinery, put a lighted candle or lantern inside the pump, when a violent explosion occurred, injuring the machinery very much and seriously hurting the man. A similar procedure resulted in blowing up a vacuum pan. A sugar engineer could have avoided these accidents.

In 1899, a year noted for "green cane," one factory began operations, as usual, early in October. After a week's run had been made, grinding 400 tons of cane per day, it was learned that the cane had too little sucrose to warrant the running of the factory, even leaving out of consideration the cost of the cultivation of the cane. A competent chemist could have ascertained the same fact by a few minutes' work in his laboratory at little or no expense, and thus have saved the proprietor several thousand dollars.

A manager purchased "Clariphos" (a form of phosphoric acid in colorless solution used in clarification and washing sugars) and turned it over to the "sugar-maker" who was to use it. The "Clariphos" was condemned after a few trials as it gave a pinkish color to the juice. Later the agent who sold this chemical visited the factory and wanted to know if the "Clariphos" had given satisfaction. After being informed that its use had been unsatisfactory and having obtained the reasons therefor, the agent asked for a sample that he might examine it, and to his great astonishment found that it was not "Clariphos" but California claret that had been shipped by mistake. These samples show how unsafe it is to place the use of chemicals or the use of the same (for sugar is truly a chemical) in the hands of those who are not trained in chemistry.

Data collected from one plantation showed that it required annually $60,000 worth of cane (about one-sixth of the crop) for planting purposes. The value of this proportion of the Louisiana cane crop amounts to enormous sums of money each year, and yet more than its equivalent in cane tops (good for planting) is thrown away during the grinding season. Planters, in speaking of this apparent lack of economy, say that the reason for planting only good cane and not tops is two-fold, namely: first, it is difficult to prepare all the land to be planted in any one year so that it will be ready for planting in the fall, hence cane must be windrowed for winter or spring planting; second, it is not possible to command labor enough to carry on the planting and manufacturing at the same time. While these reasons are not without foundation, it appears that there is great room for a revolution to be made in reorganizing the labor system or developing and adopting a system of mechanically driven plows and cultivators for this section, which reorganization would enable planters to utilize their cane tops, thus adding millions of dollars to the State.

Another source of great loss is, perhaps, in fuel. Probably not a planter in Louisiana requires flue gas analysis in order to ascertain whether economical firing is being practiced. Improper firing might result in the loss of thousands of dollars in one season, and the only way to distinguish between proper and improper firing is by analysis of the gases in the flue.

Probably the heaviest loss to the planter is that amount of sugar, varying from 25 to 35 per cent of the weight of the refuse molasses, which is very unprofitably disposed of. This sugar ought to be recovered or converted into some marketable product. In order to do this the most careful study of the difficulties involved by the best scientifically educated men will be required. An estimate on the quantity of sugar remaining in the refuse molasses of Louisiana places its value at several millions of dollars.

Other sources of loss could be given, but the few mentioned above will show the necessity for the very best trained men to superintend the cultivation of the cane and the manufacture of sugar in these days of close competition.

Sugar Engineers.—In a recent conversation with one of the ablest and most successful of Tulane's sugar engineering graduates, he stated as his opinion that there is an increasing demand for sugar engineers and that competent men will find no difficulty in securing positions with salaries from $2,000 to $2,500 per annum.

In an interview with a planter, he remarked that he pays his engineer $2,000 and gives him a vacation of three months in summer.

A young man writes that in the four years since he left school he has worked up to the position of superintendent in one of the largest sugar factories in the South, at a salary of $1,800 with a vacation in summer.

A student, by trade a sugar boiler, who has spent the greater part of two sessions at Tulane University, but who has not yet completed the course of sugar chemistry, stated that he had secured a $2,000 position during the last grinding season.

Another sugar boiler after taking a two year's course in sugar chemistry secured last year a position at $1,500, for the grinding season (about three months).

There is each year a greater demand for sugar engineers and sugar chemists from Tulane University, and the earnest, competent student never fails to find ready employment. It is true the grinding season is short, and the pay for beginners is small ($50 to $100 and expenses per month,) but a splendid opportunity is offered to the intelligent, ambitious young man, to complete his education in a practical way, and at the same time to earn a living and to impress upon the proprietor or employer the necessity for his services on the plantation or in the factory. There are, perhaps, no other professions in this section that offer such advantages to a beginner. Already ten applications have been received at the University for sugar engineers and sugar chemists to assist in taking off the next crop.

Although there is room for improvement in the mechanical part of the sugar house and a demand for well trained engineers, the casual observer in a sugar factory will readily see that mechanics in its development and application is much in advance of the chemical side of sugar manufacture. An illustration will clearly show this:

Suppose, for instance, that a certain pipe connection breaks in a sugar house and that the engineer is called upon to repair the injury. The question now is, how does the engineer go about making the repair? Does he make a rough guess at the length of the pipe necessary to replace the defective portion? Certainly not. He goes with rule in hand and takes a most exact measurement of the broken pipe, allowing for threads and expansion, before new piping is purchased or cut to repair the break. After taking the necessary pains in measuring, cutting and fitting, the new piece of pipe is made to take the place of the broken piece and a perfect connection is obtained, whereas, if the engineer had guessed at its length his work must have been a pronounced failure.

A carpenter is called in to make a door to fit a given space left in a wall. Does he go at this by guessing at the dimensions of this space, the sizes and quantity of lumber to fit said space? Most assuredly not. He takes first the exact dimensions of the space, then calculates the number of pieces of a given width and length that are necessary to construct the door. The door is made, applied to the space and there is a perfect fit, but if everything had been done by guess the carpenter's work could not have been relied upon. Thus it will be seen that for the mechanic, whether carpenter or engineer, to do successful work, he must take exact measurements of both space and materials, and this fact is known and appreciated by the ignorant as well as by the most educated employees in a sugar factory.

How is it with chemical work at most factories? A large vat is filled with juice, either sulphured or unsulphured.

The juice as it comes from the mill is a very complicated mixture of chemical substances, and the sulphuring adds to the complication. It now becomes necessary to remove, as far as is practicable, all the impurities of the juice, together with all or nearly all of the acid added to the juice by "sulphuring." In order to separate the removable portion of the impurities and sulphurous acid, it becomes necessary first to measure them and then measure the quantity of chemical or chemicals required to separate these foreign substances. The measurement of chemicals according to the standard of chemical measurement can be applied just as intelligently as the measurement of a pipe or of a door, but as a rule these accurate chemical measurements are not thought necessary by those in charge of the factory because the effect is not visible, consequently they are not carried out. The clarification or chemical work in this section is generally conducted in the following manner:

A large vat or pan is filled with juice either sulphured or unsulphured. Then a measured quantity of lime, the purity of which has not been ascertained by chemical test, is added to a measured quantity of juice, without making any accurate chemical test of the acidity or removable impurities in said juice, the one conducting this operation usually being guided by what is known as an "eye test," which is more or less guess work in chemical operations. Heat is then turned on, and after heating to boiling, or near that temperature, juice is run in to fill the vat, which, with its contents, is again heated to boiling, and the impurities removed by "brushing off," by sedimentation in settling tanks, or by filtration.

The above guessing system is the clarification process generally practiced in Louisiana—a process that has been in vogue for generations, without full appreciation of the fact that the process is purely a chemical one and that it should be trusted only to well trained chemists, who know chemistry, who think chemically, who can do any kind of chemical work, and who can intelligently interpret chemical results.

SUMMARY.—That the sugar planters and State of Louisiana may prosper, there is absolutely required a system of education that will produce chemical engineers, who will devote their lines to the economical planting, cultivating, gathering and transporting of sugar cane, and the production of sugar therefrom. This calls for a class capable of inventing, investigating and designing machinery and processes. The object of the course at Tulane University is to turn out such men.—Sugar Pl. Journal.

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We have received from the United States Commissioner of Fish and Fisheries at Washington, a very valuable work entitled Investigations of the Aquatic Resources and Fisheries of Porto Rico, by the United States Fish Commission steamer Fish Hawk in 1899. This work has 350 pages devoted to text descriptions of fish with 112 illustrations, many of which are richly colored plates. The existence of many of those fishes has never before been known, which renders the volume a most valuable reference book in any library. The system of fishing in use carries the nets or hooks to a very great depth, and it there where many of the rare specimens described are found. The volume can be examined at the residence of the editor. Those who are studying the fishes of Hawaii may find in this book some varieties here similar to those in Porto Rico.

## *FERTILIZING OF CANE SOILS IN THE HAWAIIAN ISLANDS.*

By J. T. Crawley.

In view of the general belief that the methods of fertilizing in the Hawaiian Islands are as good as obtain in perhaps any sugar country, and possibly better than in any other tropical country devoted to the growing of sugar, it may interest your readers to give an account of these methods together with their practical results. It would seem that a discussion of these methods would be specially pertinent at this time, because of the numerous tropical islands that we have recently become possessed of, and the paramount importance of the sugar business in these islands. The great interest attached to the question here is not that we have worked out one method of applying fertilizers for cane under all circumstances, but from the fact that our soils are so very different the one from the other, and that the climatic differences are so great in going from one district to another, and that each of these problems has been taken up separately and attacked in a scientific way. The fertilizer business has developed very fast in recent years; the kinds used and the methods of application have materially changed.

Previous to, say, ten years ago a great deal of bone meal and purely animal fertilizers, with occasional additions of potash salts, were used. This bone meal in many cases was too coarse for the plant to utilize, and was applied regardless of climatic conditions—in districts of 150 inches of rainfall per year and in other districts with but little more than 20 inches per year. Indeed in some of these districts the argument was used that the bone meal would permanently enrich the soil—a contention that is doubtless true, for it is said that this same bone meal has been dug up unchanged after lying in the soil for three years or more! A good many chemical analyses by the old methods were made of the soil by parties outside the islands, and fertilizers recommended according to these analyses, but the fertilizers themselves were rarely analyzed. This left the situation very much the same that we found in the states prior to the establishment of the various state experiment stations. Of course, under these conditions the planters did not always get an article up to the guarantee, nor yet an article suited to the conditions.

Six or seven years ago the Pacific Guano and Fertilizer Company was formed in Honolulu, for the purpose of manufacturing high grade fertilizers, and Dr. Averdam, a German of considerable experience in the phosphate and fertilizer trade, was put in charge. This marks the first important epoch in the development of the business, as Dr. Averdam brought with him the ideas of soluble fertilizers that have been worked out so well both in Europe and in the United States. An acid plant was erected, phosphates imported from Layson Island and manufactured into acid phosphate. Most of the fertilizer now sold by this company contains its phosphoric acid in a water-soluble form, from dissolved phosphates, the ammonia from sulphate of ammonium and the potash from muriate and sulphate of potash.

In 1895 the Hawaiian Experiment Station was established by the Sugar Planters' Association, with Dr. Maxwell as director and the writer as assistant director and chemist. Then began a systematic examination of soils both in place and in the laboratory, together with the collection of data as to rainfall and temperature, which has been the basis of much of the fertilizing that has been done since that time. It is not claimed here nor in what is to follow, that all improvements in fertilizing made since 1895 are due to the investigations of the Experiment Station and its recommendations, for some plantations have not changed their fertilizers, while many others have been guided from without; but it is due, in a greater measure, to these investigations of the conditions of each plantation that the fertilizers used in one district are so different now from those used in another district, and that there is a constant tendency toward high grade fertilizers —fertilizers specially prepared for the plantation where they are to be applied.

Fertilizers have been used here for many years, but those used at first, from necessity in an experimental way, did not give the satisfaction that was expected. Raw bone meal, dissolved bone meal, fish scrap, and fertilizers containing a large quantity of undissolved phosphates, were used regardless of soil and climatic conditions. The consequences were that while in wet districts the results were often good, in dry districts they were usually negative. Where the results were favorable bonemeal came into favor, since this was a large ingredient of fertilizers. The following formula will represent many of these fertilizers:

Phosphoric acid, 12 to 15 per cent, 2-3 soluble and available.

Potash, 5 per cent, with no gurantee of its source.

Ammonia, 4 per cent, with no guarantee of its source.

Regardless of the fact that very few planters had their fertilizers analyzed, the above formula left ample margin for putting in inferior and unsuitable ingredients. We are not surprised then that hair and hoof meal were largely in evidence, and that nitrate of soda was furnished in fertilizers, because of its low price in San Francisco, intended for plantations even of 150 to 200 inches of rainfall per year. Examples of a few districts, their present mode of fertilizing and the reasons therefor will illustrate the subject of this paper.

### Island of Hawaii.

Hilo District—The rainfall is very great, reaching occasionally 200 inches per annum. The soils are comparatively thin, often in the uplands being scarcely four inches in depth, resting upon an impervious subsoil from a reddish to a yellow color. This subsoil is raw and poisonous to plant life, consequently the deepening of the staple by subsoiling must be done very slowly and carefully. The following analysis represents an average of six samples analyzed by the Hawaiian Experiment Station:

| Soils of the Hilo District— | Per cent. |
|---|---|
| Nitrogen | .633 |
| Phosphoric acid | .504 |
| Potash | .257 |
| Lime | .128 |

These percentages, with the exception of lime, would seem to be satisfactory, but it must be remembered that these are old soils, and the heavy rainfall tends to wash out the soluble and available elements, and leave the insoluble and unavailable elements. This is notably the case with lime. The lime content of most Hawaiian soils is high, but in Hilo it has been largely washed out.

As illustrating this we give below the lime content of Hawaiian soils by districts:

| Hawaii— | Per cent. |
|---|---|
| Hilo District lime | .128 |
| Hamakua District lime | .187 |

| | |
|---|---|
| Kohala District lime | .240 |
| Kau District lime | 1.090 |
| Oahu lime | .380 |
| Maui | .395 |
| Kauai | .418 |

When we come to consider the available lime as determined by any reliable method we find this difference between Hilo and the dryer districts even more marked. The following analyses were made by the Aspartic acid method as devised by the Hawaiian Experiment Station, to determine the available plant food:

Available (pounds per acre) plant food in Hilo soils—

| | |
|---|---|
| Lime | 174 lbs. per acre |
| Potash | 78 lbs. per acre |
| Phos. acid | 29 lbs. per acre |

The lime shows the effects of cropping and a large rainfall. This same method applied to many of the soils of the dry districts would show an available lime content of from 2,000 to 5,000 pounds per acre. The land needs lime, and in some cases this is being supplied in the form of coral from Honolulu, caustic lime from the states, or in commercial fertilizers as lime phosphate and gypsum. Some planters have applied lime without seeing any beneficial effects, but we fancy that this is because an immediate effect is looked for as in the case of commercial fertilizers, whereas it can only be seen in a very gradual improvement, probably covering a period of a good many years.

Potash—It is only within the past few years that it has been proved that in a great many cases potash is deficient in Hawaiian soils, and there is now a tendency toward an increased use of potash. This is notably the case in the Hilo and Hamakua Districts of the Island of Hawaii, where the potash in the fertilizers often reaches 15 per cent and even higher. Where muriate of potash is applied to the soil the chlorine unites with the lime, and this being soluble, is washed out by the heavy rains. This would tend to deplete the land of lime, and for that reason muriate of potash is not used to any extent in regions of heavy rainfall. Sulphate of lime resulting from the application of sulphate of potash is not so soluble and for that reason is now generally used.

Ammonia—Nitrates, by reason of their solubility and tendency to wash out, evidently cannot be used with safety. Sulphate of ammonium is not open to the same objections, but most of the planters of Hilo prefer, and we believe with reason, to derive the greater part of the ammonia from organic material. Bone meal in past years has been used in large quantities, both alone and in connection with other fertilizers. The writer believes with Dr. Maxwell and certain of the plantation managers, that it is the ammonia and not the phosphoric acid of the bone meal that does the greatest good to the cane. Following this idea up we have recommended that tankage and fish scrap containing a large percentage of ammonia be used instead of bone meal. The most rational method of fertilizing with this article would seem to be the following:

Tankage of 10 per cent ammonia and 10 per cent phosphoric acid, or 11 per cent ammonia and 8 per cent phosphoric acid is applied in the furrow with the seed. After the cane is growing this is followed up by a top dressing of a high grade fertilizer containing a large percentage of potash in the form of sulphate of potash, a smaller quantity each of phosphoric acid and ammonia in readily available forms. In this way the most insoluble part of the fertilizer, the tankage, becomes well incorporated with the soil, and at the roots of the plants where it is most liable to be acted upon by the plant acids. Moreover, whatever particles of bone or flesh are not taken up by the crop of plant cane is in a position to be taken up by the second or rattoon crop. In this way it will be in contact with the roots of the cane for two years or more, and in that time all of the available ingredients should be utilized. The high grade soluble fertilizer is applied only to the growing crop, and in such condition as to be taken up at once. We might add here that this method in a modified form has been tried on one plantation with good results and is now being tried on others.

Hamakua District—The rainfall, besides being rather small for a sugar crop, is very uncertain. Some years are very dry while others have ample rainfall, provided it came at the right seasons. Occasionally there are very heavy rains which, because of the very porous condition of the soil, would tend to wash out all soluble ingredients not held by the soil itself. Cane is planted all the way from near sea level to 1,500 or

2,000 feet elevation. The uplands here, as in most Hawaiian lands, have a heavier rainfall than the lowlands.

Hamakua soils (Hawaiian Ex. Sta.) average of fourteen samples.

| | Per cent. |
|---|---|
| Lime | .187 |
| Phosphoric acid | .566 |
| Potash | .264 |
| Nitrogen | .572 |

The total potash is rather small and the lime also. The available potash here, as in Hilo, is small and the potash percentage in fertilizers has recently been increased. Sulphate of ammonium is used almost exclusively to furnish the ammonia, while nitrate of soda, because of the uncertainty of the rainfall, is sparingly used, and is not held in much esteem. Fertilizers used in this district have about the following composition:

8 per cent phosphoric acid soluble and available.

8 per cent ammonia from sulphate of ammonia.

Potash from sulphate of potash varying from 8 to 15 per cent.

On certain plantations fertilizers have shown wonderful results. In two well-known cases the yield of sugar has recently increased from 1 or 2 tons to 4 or 5 tons per acre. Indeed it is doubtful if some of the Hamakua plantations would pay for the cultivation were it not for the large use of commercial fertilizers.

A peculiar problem presents itself in this district. Most of the available cane lands at a low elevation have been taken in, and the only places where the plantations can develop further are in the uplands. These uplands are covered with a heavy growth of ferns and trees, and the nitrogen content of the soil is high, usually over 1 per cent. The first crop of cane is green and vigorous, producing, say, four or five tons of sugar per acre. This seems to exhaust the soil and the second crop is very small; and it takes several years to again produce a normal crop. This question was presented to Professor Hilgard by Andrew Moore, the manager of the Paauhau plantation, and he made some very exhaustive analyses of the soils. His conclusion was that notwithstanding the large nitrogen content, it is so bound up with the organic matter as to be practically unavailable to the plant; that the first crop exhausts the soil of its available nitrogen. He recommended a small dose of nitrate of soda to supply the available nitrogen. His conclusions, we believe, have been partially borne out by results, though the planters still prefer the use of sulphate of ammonium rather than nitrate of soda. It is not alone in Hamakua that a dearth of available nitrogen is seen in soils of a high nitrogen content. It might be said that as a rule the nitrogen content of Hawaiian soils is rather high, as compared with the soils of other countries, and yet in almost all cases the application of ammonium compounds and organic matter gives better results, and show more quickly than any other fertilizer ingredient.

Kohala District—The rainfall is small and even more uncertain than in Hamakua, though there are not often rains heavy enough to endanger soluble fertilizers.

| Kohala soils— | Per cent. |
|---|---|
| Lime | .240 |
| Phosphoric acid | .470 |
| Potash | .518 |
| Nitrogen | .415 |

These lands are old and poor in available elements, as the following table representing probably the average of available plant food, as found by the aspartic acid method:

| Available elements in Kohala soils— | |
|---|---|
| Lime | 200 to 300 lbs. per acre |
| Potash | 35 to 75 lbs. per acre |
| Phosphoric acid | 15 to 20 lbs. per acre |

These figures are extremely small and show the urgent need of high grade soluble fertilizers. Strange to say, certain of the planters still apply bone meal, and low grade and comparatively insoluble fertilizers, believing that they give as good results as the high grade. Fertilizers have not been very successful in Kohala, due largely to the droughts, and we fancy also to the kinds of fertilizers used. If there is one district where science would dictate the use of a soluble fertilizer it is in Kohala, where there is not sufficient rainfall to cause the decomposition of bone meal and allied substances. Of late years potash is being used more largely, and on at least one plantation more soluble fertilizers. Irrigation plants are being installed, and no doubt with a control of the water, fertilizers will be more generally used and with profit to the plantations.

Oahu—Almost all of the plantations of this island have irrigation plants. The rainfall is small but the supply of water is controlled by pumps. On the famous Ewa plantation the ordinary agricultural analysis does not show marked quantities of phosphoric acid, lime, nitrogen and potash. Most of the soil, however, is a washed soil, finely divided and very deep. The method of fertilizing there is different from most places. Soon after the crop begins to grow it is given a top dressing of a high grade soluble fertilizer and this is followed up by one or two dressings of nitrate of soda, and another of fertilizer. A few years ago the fertilizer contained:

8 per cent available phosphoric acid.

$7\frac{1}{2}$ per cent potash from sulphate of potash.

$6\frac{1}{2}$ per cent ammonia from three sources, nitrate of soda, sulphate of ammonium and organic.

Both the potash and ammonia were afterwards increased and the phosphoric acid decreased. At the present time all of the ammonia is derived from nitrate of soda and sulphate of ammonium, and most of the phosphoric acid from water-soluble phosphates. This is that the fertilizer may be soluble in the water of irrigation. Labor on the plantations is scarce and more expensive than formerly and every labor saving method possible must be used. The fertilizer is applied in the cane rows and followed up by irrigation water which dissolves the fertilizer and carries it down to the roots of the cane. In this way no labor is required to cover the fertilizer as was formerly the case. The enormous yields of Ewa are made possible by the extreme depth of the soil, and the large quantities of manures used. There is not the danger of losing the nitrate of soda that there would be were the soil of less depth.

On other plantations of the island nitrates are used but not to the same extent, and the high grade fertilizers contain both sulphate of ammonium and organic ammonia. The following will represent about an average formula for use on an irrigated plantation:

Fertilizers used on Oahu—

$\frac{7}{8}$ per cent phosphoric acid soluble and available.

8-10 per cent potash from sulphate of potash.

$\frac{7}{8}$ per cent ammonia, 1-3 each from nitrate of soda, sulphate of ammonium and organic.

Chemical analysis shows rather a lower content of nitrogen in the soils, and ammonium compounds give very good results.

Maui.—Most of the plantations of Maui are situated in or near a broad plain that divides the two parts of the island, and are subject to approximately the same weather conditions, though the soils differ from each other very essentially. As in other districts, no analysis can be given to represent the whole district, yet for purpose of comparison we give an average of a number of analyses:

| Soils of Maui, near Wailuku— | Per cent. |
|---|---|
| Phosphoric acid | .270 |
| Lime | .295 |
| Potash | .357 |
| Nitrogen | .388 |

There is nothing unusual in these percentages; the nitrogen is rather low, and none of the percentages are very high. All of the plantations in or near this plain are irrigated plantations, the rainfall being very small. Most of the plantations use ammonia from the three forms, nitrate, sulphate and organic; potash from sulphate of potash, and phosphoric acid from soluble phosphates. Here again the phosphoric acid in the fertilizers has been materially reduced, and the potash and ammonia proportionately increased. At Spreckelsville the management formerly used large quantities of fish scrap and fertilizers carrying a large quantity of phosphoric acid, but since the plantation has changed ownership approximately the same methods of fertilizing have been adopted which have given such good results at other places. Most of the plantations under consideration are under one management, and the most intelligent attempt has been made to fertilize in a scientific manner that has as yet been made anywhere in this territory. Analyses of the various fields have been made to determine the available plant food. These large fields being comparatively uniform in composition, it is possible to get samples representing a number of acres. From these analyses different fertilizers are recommended and used for the different fields.

To illustrate, we give a few analyses of these soils, together with the fertilizers used:

Maui soils, available elements per acre—

| | A | B | C | D | E |
|---|---|---|---|---|---|
| | lbs. | lbs. | lbs. | lbs. | lbs. |
| Lime | 5,619 | 5,040 | 5,808 | 4,344 | 6,618 |
| Potash | 1,425 | 1,443 | 894 | 1,097 | 2,193 |
| Phosphoric acid | 27 | 20 | 136 | 30 | 34 |

Lime is ample in all the samples, phosphoric acid is low, the potash varying between quite wide limits. The nitrogen, while not given here is tolerably constant, and the fertilizers used would be about as follows:

A and B—8 per cent phosphoric acid, soluble and available. 8 per cent ammonia, 1-3 from nitrate, 2-3 from sulphate and organic. 8 per cent potash from sulphate of potash.

C—7 per cent phosphoric acid soluble and available. 8 per cent ammonia as above. 10 per cent potash from sulphate.

D—9 per cent phosphoric acid, soluble and available. 8 per cent ammonia as above. 8 per cent potash from sulphate.

E—8 per cent phosphoric acid soluble and available. 8 per cent ammonia as above. 5 per cent potash from sulphate.

A neighboring plantation whose soil shows a lower potash than any of the above is using a fertilizer containing 11 per cent potash, while occasionally the ammonia is increased if any special circumstances warrant the same. Special dressings of nitrate of soda, and occasionally nitrate and ground coral, are applied.

The plantations on Kauai, with a few exceptions, do not present problems very different from those already mentioned. One plantation uses two kinds of fertilizers, one for plant cane and another for ratoon; for the former a high grade soluble fertilizer, applied in liberal quantities, and for the latter a mixture of muriate of potash, nitrate of soda and ground coral. The soil is something deficient in lime, hence the coral; and the manager uses the nitrate with the ratoon crop for the purpose of stimulating the growth of the cane, believing that in this way whatever fertilizer applied to the plant cane the year before is not taken up by the cane, will be used by this second crop. Theoretically, this is an economical method of fertilizing, but the writer has recommended an application of a high grade fertilizer to the ratoon crop on other plantations following this method, where the soils show any signs of becoming depleted.

Special Cases.—The seasons and existing conditions often determine the fertilizer to be applied. For instance, in one case a fertilizer was wanted in July for a cane to come off the following season. This is later than fertilizers are usually applied, but the cane needed a stimulant. Evidently whatever fertilizer was to be applied, should be readily available, and the following formula was used:

12 per cent phosphoric acid, soluble and available, from double super-phosphate.

10 per cent ammonia, 6 per cent from nitrate, 6 per cent from sulphate of ammonium.

Where the fertilizer is to be applied with the seed, a little more insoluble form can be used than when it is to be applied as a top dressing, and fertilizers applied early in the season a little more insoluble than those to be applied later, since the crop has a longer time to grow and utilize the food.

Of the forms of potash, sulphate has the decided preference among the planters. Why this is so I am unable to say, or whether the preference is founded on facts or on prejudice. There is very little difference between the price of sulphate and muriate, a slight advantage being with the muriate. My own advice has usually been for the use of sulphate. In some cases the excessive rainfall necessitates the use of sulphate, and in a few cases there is a large quantity of salt, or chloride or sodium, either in the soil or water, or in both; and in these cases it is safer to use the sulphate. Since there is very little difference in the price, it is probably a good and safe practice to use that form in which there can be the least danger.

Sandy Soils—There are many patches of so-called "sandy soil," some of them quite extensive, on the plantations and they require special treatment. The writer has had this problem presented a number of times, and it furnished the subject for a little chemical investigation, the results of which were published in the Hawaiian Planters' Monthly for February, 1901. This sand is composed of fine particles of coral, in which there is incorporated more or less of soil and organic debris. It is quite porous and for that reason difficult to irrigate. The water passes through the porous coral very readily and the rows, or irrigating trenches, have to be very short. The investigation had for its object the determination of the retentive power of such soil both for water and for chemicals, soils of varying quantities of coral being used in the tests. It was proved, as was expected, that the soils containing above 80 per cent of coral sand have very feeble retentive power, both for water and for salts. Nitrate of soda, muriate of potash, and to a certain extent, sulphates of potash and ammonium, being washed out by waters of irrigation. Phosphates are readily retained owing to the lime content of the coral sand. It was recommended that phosphates, blood, sulphate of potash (and sulphate of ammonium in small quantities) be used, and this recommendation is being carried out both on the Kahuku and Kihei plantations. Both of these plantations now use two different formulas, one for the rich red soil and the other for the sandy soil.

In conclusion, it might be stated that the general tendency is toward the use of more soluble fertilizers, a larger quantity of potash and ammonium compounds and less phosphoric acid, especially when in the form of bones or undissolved phosphates. The planter sees that the freight on a ton of low grade fertilizer is the same as on a ton of high grade, and being so far away from the sources of supply it is economy to use the most concentrated goods.

These changes have been followed by splendid results. It is a well-known fact that the yield of sugar per acre has enormously increased during the past few years. Six years ago the average for the islands was 6,300 pounds of sugar per acre, while now it is four and a half tons per acre. Of course, a more careful cultivation, and great improvements in mills have added their part in this improvement; and we must not forget that the alert, intelligent management of the plantations, which is at the very foundation of the recent enhanced values of the sugar properties, has made it possible for these increased yields. But certainly, after all is said commercial fertilizers pay for themselves many times over.

Methods of Soil Analysis.—The ordinary agricultural analysis is still used, and, with a careful interpretation, gives indications of the needs of the soil. The aspartic acid of the Hawaiian Experiment Station is also quite often used, and seems to give good indications of the condition of availability of the potash and lime. But it is doubtful if the method is applicable to phosphoric acid. According to the method there are extremely small quantities of available phosphoric acid in any of our soils, which comports with our belief that it is locked up with the titanium and iron and aluminum; and yet the applications of phosphoric acid have not been attended by a large increase of sugar. Indeed, as has already been stated, the tendency is to decrease rather than to increase this element in commercial fertilizers.

The quantity of fertilizers applied per acre varies considerably. The average is probably 800 to 1,000 pounds per acre, while in cases it varies from 500 to 1,500 pounds per acre. This, it is to be remembered, is in addition to whatever nitrate is applied, which is looked upon as a stimulant.

Nothing thus far has been said concerning the elements withdrawn by the crops from the soil, and it would seem that our methods of fertilizing do not take this into account. It has long been a favorite theory with agriculturists that we should return the exact quantities of elements that are withdrawn by one crop, and chemists have been to great pains and expense to analyse all agricultural plants with a view to compounding for each crop a fertilizer that will supply this drain. Looked at casually, this seems to be a correct theory, but it does not bear close investigation. It does not take into account the fact that the elements in the soil are not available in the exact ratio of their removal by the crops, and that the rocks are being disintegrated constantly and yielding up plant food in very different ratios in different places. A consideration of the chemical composition of Hawaiian lavas from which the soils are derived will show this.

Lime in Hawaiian lavas (see Maxwell: Soils and Lavas).

| | |
|---|---|
| Non-hydrous lavas | 9.24 per cent |
| Hydrous lavas | 8.23 per cent |
| Tufas | 1.41 per cent |

Evidently the resulting soils would differ very materially in their content of lime, and any system of supplying lime to the soil that does not take these differences into account is wrong. Likewise the potash and phosphoric acid differ very essentially in these rocks and consequently in the soils. Again, the rains percolating through the soil carries off these elements in very different proportion. Maxwell: Lavas and Soils, page 164, says: "In the passing over of lavas into soils there have been removed 8 tons (89 per cent) out of every 9 tons of lime; one-half ton (33 per cent) out of every $1\frac{1}{2}$ tons of potash."

The resultant condition of the soil say in Hilo, where the rainfall is 200 inches per year, percolating through the soil and carrying off lime and potash would be very different from Ewa plantation where there is very little rainfall and where each million gallons of water with which the plantation is irrigated carries with it 400 pounds lime and 80 pounds potash and 14 pounds phosphoric acid. In 12 different samples of soil collected by the Hawaiian Experiment Station from 11 plantations, the available lime varied from 105 to 983 lbs. per acre; potash varied from 30 to 588 lbs. per acre; phosphoric acid varied from 10 to 86 lbs. per acre.

If the exact amount of lime, phosphoric acid and potash that one crop removes were sufficient for the poorest of these soils, a very much smaller quantity would suffice for the richest.

The rainfall is a very much more powerful agent in depleting the soil of its soluble ingredients in wet districts than is recropping, nevertheless an examination of the elements removed by cropping will show that our fertilizers tend in the right direction. According to the bulletin of the Experiment Station for 1900 the Rose Bamboo cane removes each year for each ton of sugar produced

13.6 lbs. phos. acid
114.2 lbs. potash
34.8 lbs. lime
40.5 lbs. nitrogen

or for a crop of ten tons per acre

136 lbs. phos. acid
1142 lbs. potash
348 lbs. lime
405 lbs. nitrogen.

The amount of potash removed is enormous and to replace this would require more than a ton of the commercial sulphate. The nitrogen also is quite high, while there is a comparatively small quantity of phosphoric acid. This comports with the present practice of an increase of the potash and nitrogen and decrease of the phosphoric acid in commercial fertilizers.—J. T. Crawley in Lou. Planter.

## COLORED AND WHITE LABOR IN QUEENSLAND.

A short time ago, the Queenslander, in view of the great importance of the question of colored labor for the well-being of the sugar industry, the supply of which is threatened with being eventually stopped by the action of the Federal Government, sent a special commissioner to report on the circumstances connected with the present carrying on of the industry in Queensland. * *

The Queenslander Commissioner visited the Isis, Bundaberg, and Bingera districts, and the result of his investigations shows the fallacy of the idea of carrying on profitable production of cane sugar with only white men as laborers. One cane planter or farmer after another told the same story of the unreliability of the white laborer, of his physical unfitness for heavy work of trashing and cutting in tropical canefields, his indisposition for such continued heavy work, his insolence and insubordination and absurd and unfair demands, and finally the irregularity of the supply of such labor. To this must be added the intermittent nature of the demand for special labor connected with trashing and cutting, as it only lasts at most about three months every year.

The experience of the Hawaiian Islands is alluded to by the reporter. In that country, contrary to the constitutional law of the United States, the planters were allowed to employ Asiatic labor for a time, and meanwhile agents were despatched to the United States and Canada, who sent over several gangs of white laborers. They were set to work and received good wages, but they got tired of the work and paid the colored laborers to do it for them.

The Australian Premier, who has been making a tour in Queensland, said that small holdings would solve the problem of white v. black labor, totally overlooking the fact that even though the productiveness of the land were greatly increased by this system, still the main difficulty would remain, that of the incapacity of the white man for such severe physical exertion under a tropical sun in the close atmosphere of the canefield.

The managers of the Childers mill, belonging to the Colonial Sugar Refining Company, did not think there was the slightest possibility of getting white men to work in the canefields, even in Southern Queensland, notwithstanding its close proximity to the principal labor centers.

The farmers in the Bundaberg district, who all employ Kanakas for cane cutting, considered the white man to be capable of the work, but stated he would not do it at any price if he could avoid it, as it taxed the physical endurance of the strongest man, they further said there was often a scarcity of such labor just at critical junctures.

The managers of a large plantation in the Bundaberg district were of opinion that if they were deprived of Kanaka labor it would be impossible to continue cane growing, and related the experience of three white men who came from New South Wales and took up 40 acres of scrub land, fully intending and resolved to do their own work, but who eventually had to beg for a gang of Kanakas to complete the work and then left the district. The man who next took up the land worked it by the ordinary method, using colored labor for the heavy work, and is there still, doing well.

The proprietor of another plantation mentioned, among other statements (all to the same effect as those previously heard), having once engaged twenty-one white laborers to cut cane. They started in the early morning, but when the overseer went an hour or two later to see how the work was progressing, he found all gone but three, and the cane cut a foot from the ground.

One of the Messrs. Young, the well-known proprietors of Fairymead plantation, who have had some twenty years' experience of the district, spoke emphatically on the question of Polynesian labor as a necessity from the point of view of the maintenance of the labor supply, as well as from that of the financial success of the industry.

The farmers of the Bingera district were "singularly unanimous in expressing a determination to abandon cane cultivation if the only reliable means of carrying it on, that of using Kanaka labor, were rendered unavailable." They are all strong democrats, but recognize that the success of the industry is only possible with the aid of the Kanaka. The representative of the Queenslander closes by saying that as he neared the end of his investigation in the sub-tropical districts, he could only reflect on the monotonous reiteration of the answer: "Impossible to grow sugar successfully without the Kanaka," even though some of the farmers who gave this opinion held what might be termed strong "labor views." In one case the manager "dismissed the question with a contemptuous wave of the hand." The following seems conclusive: "The manager of the Millaquin and Yengari Sugar Company, of Bundaberg, gave some interesting particulars concerning the employment of Polynesian labor and its effect on the industry, both as regards the production of the sugar and the subsequent refining process. When the crisis occurred due to legislation preventing the Kanaka from being employed in the sugar fields, much land being cleared to supply new mills was allowed to revert to forest, and contemplated new mills were not proceeded with. Machinery manufactured for the purpose was offered at a very low price without its being removed from the packing cases. Melbourne capitalists who had invested in Mackay sugar fields foresaw that the industry was doomed in Queensland, and in the year 1890, therefore, joined with others and erected a sugar refinery at Port Melbourne. For four years the Company refined sugar made in Java by forced black labor, not only in the fields but in the mills. This meant that the wages for white men for manufacturing 60,000 tons of raw sugar were diverted from Queensland to Java, and given to Javanese, Chinese, &c. This amount of raw sugar, it must be remembered, represented 600,000 tons of cane. Had this amount of cane been grown in Queensland it would have been of great benefit to the State in the early nineties."

On the change in the legislation, the sugar industry at once expanded again; the refining of Java sugar in Melbourne ceased, and the Company established a refinery at Brisbane, while the Millaquin Company erected one at Bundaberg. These two undertakings pay out yearly for cane, coal and other materials, general manufacturing charges, packing materials, wages, &c., about £500,000, an annual expenditure in the State which has directly proceeded from the restoration of Kanaka labor. "The increase in the output of sugar tells its own tale. It goes to show that while the immigration of the Kanaka was held in abeyance, the industry also remained in abeyance, and when the embargo was removed, the output of sugar increased the following year by nearly fifteen thousand tons."

The following extract from an article in the Queensland Agricultural Journal is interesting, as bearing upon the contention that white men can work on the sugar fields of tropical Queensland:

"It has been stated that trashing is unnecessary, and the controversy on that point is as old as sugar growing, but all I can say is that the planter who does not trash runs three risks at least. One is that during continued wet weather the rain lodges at the joints of the cane just at the buds, and is held there by the trash. The next thing is, the buds swell and quickly grow into suckers all up the cane, thus reducing the density of the juice and causing more labor to dress the cane for the mill. I have had a whole field of cane in this state, owing to want of hands to trash, and to the refusal of the regular hands—plowmen, horse drivers, &c.—to save the crops by doing the work.

"The second risk is that the trash harbors numbers of insects, such as borers, which injure the cane; and the third is, that, at a time when the cane requires all the sun and air it can get to ripen it and raise the sugar contents of the juice, it is smothered in a mass of dead leaves which effectually keep off light, sun and air. Again, when cane cutting is going on, the heaps of trash collected at the foot of the cane stools give the cutters harder work to do. Now, picture to yourself a 50 or 100 acre field of well-grown cane. It stands from eight to ten feet high, in serried rows some six feet apart, with half that distance between the stools of cane, which number from six to twelve canes per stool. Much of the cane has been blown down, and lies in a tangled mass under foot. Every single cane is clothed with a casing of dead leaves from the ground to the green crown. This is the so-called 'trash' which has to be removed to enable the sun and air to act directly on the cane.

"Enter this field, and a few yards from its outside edge you will find it difficult to force your way further. Overhead the pitiless blazing sun of the tropics. Should there be any breeze at all, not a breath of it can find its way further than a few yards into the thickly growing cane. The thermometer stands at from 120° to 150° Fahr. in the sun, and added to this there is a deadly muggy dampness everywhere, which renders the heat more oppressive.

"The trash is easily detached from the cane stalk—a child can pull a dead leaf off with his finger and thumb. All that the laborer has to do is to throw himself upon the stool of cane, plunge both arms into the accumulated trash, drag it clear of the cane, and deposit it in the clear space between the rows. The canes are thus left quite bare from root to crown. Easy enough you say, the trash is neither heavy nor prickly. No, but as the work is usually done in dry weather, clouds of fine dust rise from the crackling leaves. The laborer is smothered with this dust, which gets into his eyes and nostrils, covers his whole body with streaming dirt, and chokes up his bronchial tubes as badly as if he were working a cotton gin in a close room. In addition to this annoyance, there is a still greater one, arising from the hairs fringing each joint of the cane stalk. These become detached in the process of trashing, and stick into the skin like the fine hairs on certain caterpillars or the fine spiculae on the fruit of the prickly pear. These cause intense irritation; the skin burns and itches, and there is no possible escape or relief from it till knock-off time. Then, as I have said, the blazing sun overhead beats pitilessly on the unprotected worker, the dust chokes every pore, and by the time he has worked for an hour or so, if he be a white man, small wonder that he fights shy of trashing cane."—Int. Sugar Journal.

:o:

## *RAINFALL AT KOHALA, HAWAII.*

NIULII, KOHALA, Aug. 9th, 1901.

Editor Planters' Monthly: Dear Sir—I enclose a statement of rainfall at Niulii since January, 1884, thinking that you might deem it worth space in your P. M.

We are having a disasterous spell of dry weather at an unfortunate time, delaying reaping and planting operations.

I am sir, Yours faithfully,

ROBT. HALL.

:o:

The West Java Sugar Experiment Station reports that in 51 sugar factories the average content of the cane was very low, being 12.39 per cent, as against 13.99 in 1899. Only one factory worked with diffusion and extracted 94.82 per cent of the sugar. The factories that employed the triple crushing process extracted 89.77, and those with the double crushing process 87.18 per cent. The total extraction was 90.01 per cent. The diffusion process is distinguished by the far greater purity of the juices.—Chemiker Ztg.

:o:

A special Meeting of the Sugar Planters and Agents of Plantations is being held as we go to press, but no report of its proceedings can be given in this issue of the Monthly.

## RAINFALL AT NIULII, KOHALA, HAWAII.

| | 1884 | 1885 | 1886 | 1887 | 1888 | 1889 | 1890 | 1891 | 1892 | 1893 | 1894 | 1895 | 1896 | 1897 | 1898 | 1899 | 1900 | 1901 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January..... | 4.98 | 6.86 | 3.63 | 7.46 | 2.01 | 2.74 | 11.94 | 11.44 | 7.89 | 4.99 | 1.50 | 2.14 | 2.79 | 2.86 | 6.19 | .93 | 2.28 | 2.52 |
| February..... | .90 | 5 84 | 2.22 | 4.96 | 2.64 | 2.00 | 6.04 | 5.91 | .91 | 3.34 | 7.24 | 2.53 | 5.46 | 2.51 | 2.82 | 1.85 | 3.82 | 13.14 |
| March ....... | 4.95 | 4.75 | 1.96 | 7.16 | 4.06 | 3.06 | 12.88 | 4.42 | 3.78 | 5.12 | 5.68 | 2.85 | 6.52 | 1.35 | 13.34 | 7.07 | 2.70 | 7.11 |
| April,........ | 15.24 | 9.35 | 4.80 | 1.63 | 4.77 | 2.00 | 5.31 | 6.30 | .58 | 4.64 | 3.43 | 11.96 | 4.07 | 1.42 | 2.34 | 2.94 | 4.90 | 6 62 |
| May ......... | 3.97 | 11.16 | 7.71 | 4.44 | 6.06 | 2.42 | 8.74 | 1.84 | 3.91 | 3.71 | 2.37 | 3.41 | 2.49 | 1.17 | 3.91 | 2.38 | 9.39 | .07 |
| June......... | 2.49 | 5.63 | 6.06 | 1.34 | 4.24 | 3.08 | 8.69 | 1.08 | 2.04 | 3.46 | 2.28 | 3.20 | 4.19 | .85 | 2.80 | 2.43 | 2.07 | .65 |
| July ......... | 4.99 | 8.67 | 4.17 | 6.02 | 5.16 | 3.98 | 10.74 | 3.26 | 1.70 | 4.17 | 3.74 | 3.46 | 4.43 | 1.48 | 3.26 | 5.88 | 3.31 | 1.01 |
| August....... | 4 37 | 3.30 | 3.74 | 5.42 | 4.93 | 5.45 | 12.15 | 9.42 | 4.33 | 1.41 | 3.07 | 5.07 | 3.11 | 4.80 | 3.17 | 4.21 | 4.05 | ...... |
| September ... | 2.27 | 8.71 | 7.22 | 2.52 | 3.10 | 3.90 | 3.05 | 3.90 | 3.32 | .62 | .82 | 3.67 | 1.65 | 1.52 | 2.38 | 3.90 | 1.76 | .... |
| October...... | 3.31 | 3.56 | 1.28 | 2.53 | 1.75 | 6.56 | 4.61 | 7.38 | 2.18 | 1.21 | 2.61 | 2.49 | 3.96 | 1.90 | 2.94 | 7.31 | 6.48 | ...... |
| November.... | 3.07 | 7.83 | 2.43 | 2.91 | 4.79 | 8.23 | 4.70 | 1.12 | 1.94 | 1.47 | 8.20 | 10.60 | .53 | 3.48 | 5.27 | 3.11 | 4.15 | ..... |
| December .... | 7.42 | 9.95 | 4.70 | 2.55 | 2.81 | 7.40 | 7.80 | 3.27 | 5.54 | 1.05 | 10.25 | 1.31 | 4.30 | 2.93 | 3.33 | .66 | 1.45 | ..... |
| TOTALS | 57.96 | 85.86 | 49.92 | 48.94 | 46.32 | 50.82 | 96.65 | 59.34 | 38.12 | 35.19 | 51.19 | 52.69 | 43.50 | 26.27 | 51.75 | 42.67 | 46.36 | ..... |

# HONOLULU STOCK AND BOND EXCHANGE, SEPT. 17, 1901.

| STOCK | Capital Authorized | Shares Issued | Capital Paid up | Par Value | Last Sale |
|---|---|---|---|---|---|
| MERCANTILE | | | | | |
| C. Brewer & Co. | $ 1,000,000 | 10,000 | $ 1,000,000 | $ 100 | 415 |
| N. S. Sachs' Dry G'ds Co. L'd. | 60,000 | 600 | .......... | 100 | 100 |
| L. B. Kerr & Co., Ltd | 200,000 | 4,000 | .......... | 50 | ..... |
| SUGAR | | | | | |
| Ewa Plantation Company | 5,000,000 | 250,000 | 5,000,000 | 20 | 25 |
| Hawaiian Agricultural Co. | 1,000,000 | 10,000 | 1,000,000 | 100 | 275 |
| Hawaiian Com'l & Sugar Co. | 10,000,000 | 100,000 | 2,312,750 | 100 | 80 |
| Hawaiian Sugar Company | 2,000,000 | 100,000 | 2,000,000 | 20 | 25 |
| Honomu Sugar Company | 750,000 | 7,500 | 750,000 | 100 | 130 |
| Honokaa Sugar Company | 2,000,000 | 100,000 | 2,000,000 | 20 | 33¼ |
| Haiku Sugar Company | 500,000 | 5,000 | 500,000 | 100 | ..... |
| Kahuku Plantation Company | 500,000 | 25,000 | 500,000 | 20 | 22¼ |
| Kihei Plant. Co. Ltd. | 2,500,000 | 50,000 | 2,500,000 | 50 | 11 |
| Kipahulu Sugar Company | 160,000 | 1,600 | 160,000 | 100 | ..... |
| Koloa Sugar Company | 500,000 | 5,000 | 500,000 | 100 | 164 |
| Kona Sugar Company | 500,000 | 5,000 | 500,000 | 100 | ..... |
| McBryde Sug. Co. Ltd. | 3,500,000 | 175,000 | 3,500,000 | 20 | 10 |
| Nahiku Sug. Co. Ltd. Assess. | 675,000 | 33,750 | .......... | 20 | ..... |
| Nahiku Sug. Co. Ltd. Pd. up | 75,000 | 3,750 | 75,000 | 20 | ..... |
| Oahu Sugar Co | 3,600,000 | 36,000 | 3,600,000 | 100 | 125 |
| Onomea Sugar Co | 1,000,000 | 50,000 | 1,000,000 | 20 | 23¼ |
| Ookala Sugar Plantation Co. | 500,000 | 25,000 | 500,000 | 20 | 10 |
| Olaa Sugar Co. Ltd., Assess. | 2,500,000 | 125,000 | 865,000 | 20 | 2 |
| Olaa Sugar Co. Ltd., Paid up | 2,500,000 | 125,000 | 2,500,000 | 20 | 12 |
| Olowalu Company | 150,000 | 1,500 | 150,000 | 100 | ..... |
| Paauhau Sug. Plantation Co. | 5,000,000 | 100,000 | 5,000,000 | 50 | ..... |
| Pacific Sugar Mill | 500,000 | 5,000 | 500,000 | 100 | ..... |
| Paia Plantation Company | 750,000 | 7,500 | 750,000 | 100 | 250 |
| Pepeekeo Sugar Company | 750,000 | 7,500 | 750,000 | 100 | ..... |
| Pioneer Mill Company | 2,250,000 | 22,500 | 2,250,000 | 100 | 95 |
| Pioneer Mill Company Ass. | 500,000 | 5,000 | 125,000 | 100 | 25 |
| Waialua Agricultural Co. | 4,500,000 | 45,000 | 4,500,000 | 100 | 70 |
| Wailuku Sugar Company | 700,000 | 7,000 | 700,000 | 100 | 370 |
| Waimanalo Sugar Company | 250,000 | 250,000 | 250,000 | 100 | 150 |
| Waimea Mill Company | 125,000 | 125,000 | 125,000 | 100 | 87 |
| MISCELLANEOUS | | | | | |
| Wilder Steamship Company | 500,000 | 5,000 | 500,000 | 100 | 100 |
| Inter-Island Steam Nav. Co. | 600,000 | 6,000 | 600,000 | 100 | 100 |
| Hawaiian Electric Company | 300,000 | 3,000 | 300,000 | 100 | 110 |
| Honolulu R. T. & Land Co. | 250,000 | 2,500 | 250,000 | 100 | ..... |
| Mutual Telephone Company | 150,000 | 13,900 | 139,000 | 10 | 9 |
| Oahu Railway & Land Co | 4,000,000 | 40,000 | 4,000,000 | 100 | 105 |
| People's Ice & Refrig. Co. | 150,000 | 1,500 | 150,000 | 100 | 85 |
| BANKS | | | | | |
| First National Bank | 500,000 | 5,000 | 500,000 | 100 | ..... |
| First Am. Sav. B. & Trust Co. | 250,000 | 2,500 | 250,000 | 100 | ..... |
| BONDS | Amt. of Issue | | | | |
| Hawaiian Govt. 5 per cent | 1,251,200 | Dec. 31, 1900 | .......... | ..... | 96 |
| Hilo Railroad Co., 6 per cent | 450,000 | ...... | .......... | ..... | 100 |
| Hilo R. R. Co., 6 per cent | 150,000 | ...... | .......... | ..... | ..... |
| Hono. R. T. & L. Co, 6 p. c. | 300,000 | ...... | .......... | ..... | ..... |
| Ewa Plantation 6 per cent | 500,000 | ...... | .......... | ..... | 100 |
| Oahu Railway & L'd Co. 6 p. c. | 2,000,000 | ...... | .......... | ..... | 105 |
| Oahu Plantation 6 per cent | 750,000 | ...... | .......... | ..... | ..... |
| Olaa Plantation 6 per cent | 1,250 000 | ...... | .......... | ..... | ..... |
| Waialua Agr. 6 per cent | 1,000,000 | ...... | .......... | ..... | 102¼ |

# PLANTATION DIRECTORY.

| Island and Name. | | Manager. | Post Office |
|---|---|---|---|
| **OAHU.** | | | |
| Ewa Plantation Co | * | G. F. Renton | Honouliuli |
| Waianae Sugar Co. Ltd | *** | Fred Meyer | Waianai |
| Waialua Agricultural Co | * | W. W. Goodale | Waialua |
| Kahuku Plantation Co | xx | W. A. Baldwin | Kahuku |
| Waimanalo Sugar Co | ** | G. C. Chalmers | Waimanalo |
| Oahu Plantation Co | x | Aug. Ahrens | Waipahu |
| Honolulu Sugar Co | ** | J. A. Low | Aiea |
| Heeia Agricultural Co. Ltd | *x* | W. W. McGowan | Heeia |
| Laie Plantation | x*x | S. E. Wooley | Laie |
| **MAUI.** | | | |
| Olowalu Sugas Co | ** | E. Kruse | Lahaina |
| Pioneer Mill Co | x | L. Barckausen | Lahaina |
| Wailuku Sugar Co | **x | C. B. Wells | Wailuku |
| Hawaiian Commercial & Sugar Co | x* | W. J. Lowrie | Spreckelsville |
| Paia Plantation | x* | D. C. Lindsay | Paia |
| Haiku Sugar Co | x* | H. A Baldwin | Hamakuapoko |
| Hana Plantation | xx | K. S. Gjerdrum | Hana |
| Hamoa Plantation | **x | J. R. Myers | Hamoa |
| Kipahulu Sugar Co | x | A. Gross | Kipahulu |
| Kihei Plantation | x* | W. F. Pogue | Kihei |
| Maui Sugar Co | † | W. S Akana | Huelo |
| **HAWAII.** | | | |
| Paauhau Plantation | ** | Jas. Gibb | Honokaa |
| Hamakua Mill Co | *x | A. Lidgate | Paauilo |
| Kukaiau Plantation | x | J. M. Horner | Paauilo |
| Kukaiau Mill Co | *x | E. Madden | Paaulio |
| Ookala Sugar Co | **x | W. G. Walker | Ookala |
| Laupahoehoe Sugar Co | *x | C. McLennan | Papaaloa |
| Hakalau Plantation | ** | Geo. Ross. | Hakalau |
| Honomu Sugar Co | **x | Wm. Pullar | Honomu |
| Pepeekeo Sugar Co | *x | H. Deacon | Pepeekeo |
| Onomea Sugar Co | **x | J. T. Moir | Papaikou |
| Hilo Sugar Co | ** | J. A. Scott | Hilo |
| Hawaii Mill Co | x | W. von Graevemeyer | Hilo |
| Waiakea Mill Co | *x | C. C. Kennedy | Hilo |
| Hawaiian Agricultural Co | **x | C. M. Walton | Pahala |
| Hutchinson Sugar Plantation Co | ** | G. C. Hewitt | Naalehu |
| Union Mill Co | *x | Jas. Renton | Kohala |
| Kohala Sugar Co | * | E. E. Olding | Kohala |
| Pacific Sugar Mill | x** | D. Forbes | Kukuihaele |
| Honokaa Sugar Co | x** | Jno. Watt | Honokaa |
| Kona Sugar Co | xxx | J. Cowan | Holualoa |
| Olaa Sugar Co | xx* | F. B. McStocker | Olaa |
| Puna Sugar Co | xx* | W. H. Campbell | Kapoho |
| Halawa Plantation | x*x | T. S Kay | Kohala |
| C. F. Hart, (Niulii) | *x | R. Hall | Kohala |
| Hawi Mill & Plantation | †† | John Hind | Kohala |
| **KAUAI.** | | | |
| Kilauea Sugar Co | ** | G R. Ewart | Kilauea |
| Gay & Robinson | x*x | Gay & Robinson | Makaweli |
| Makee Sugar Co | **x | G. H. Fairchild | Kealia |
| Grove Farm Plantation | x | G. N. Wilcox | Lihue |
| Lihue Plantation Co | x | F. Weber | Lihue |
| Koloa Sugar Co | x | P. McLain | Koloa |
| McBryde Sugar Co | *x | W. Stodart | Eleele |
| Hawaiian Sugar Co | x* | | Makaweli |
| Waimea Sugar Mill Co | * | J. Fassoth | Waimea |
| Kekaha Sugar Co | x | H. B Faye | Kekaha |

| Key | Honolulu Agents | |
|---|---|---|
| * | Castle & Cooke | (4) |
| ** | W. G. Irwin & Co | (8) |
| *** | J. M. Dowsett | (1) |
| x | H. Hackfeld & Co | (9) |
| xx | M. S. Grinbaum & Co | (2) |
| xxx | McChesney & Sons | (1) |
| *x | T. H. Davies & Co | (8) |
| **x | C Brewer & Co | (7) |
| x* | Alexander & Baldwin | (5) |
| x** | F. A. Schæfer & Co. | (2) |
| xx* | B. F. Dillingham & Co | (2) |
| x*x | H. Waterhouse & Co. | (3) |
| *x* | C. Bolte | (1) |
| † | Wong Kwai | (1) |
| †† | Hind, Rolph & Co | (1) |